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RADIOACTIVE CONTAMINATION IN THE HANFORD ENVIRONS

FOR THE PERIOD

OCTOBER, NOVEMBER, DECEMBER

1955

BEST AVAILABLE COPY

By

B. V. Andersen and J. K. Soldat

Regional Monitoring Unit

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February 6, 1956

HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON

Operated for the Atomic Energy Commission by
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ABSTRACT

SECTION I: RADIOACTIVE CONTAMINATION IN EFFLUENT GASES

Total average I^{131} emission from S and T-Plant stacks this quarter was 1.0 curie per day compared to 1.7 curies per day during the previous quarter. Approximately 60 per cent of this I^{131} came from the S-Plant stack where the quarterly average and maximum were 0.62 and 2.5 curies per day, respectively. Only one positive measurement of ruthenium activity density in the S-Plant stack effluents was obtained this quarter; 0.12 curie per day was emitted from this facility on December 22, 1955.

Sampling of the 105-KW and 105-KE reactor area stacks for tritium oxide, C^{14}, S^{35}, and particulate materials was initiated this quarter. Total average tritium oxide emission from the eight reactor area stacks was 1.7 curies per day. Improved efficiency of the C^{14}-S^{35} scrubber samplers attained this quarter resulted in an increased number of positive measurements for these two contaminants. Quarterly average C^{14} emission rates remained below the detection limit at all reactor areas; S^{35} emission rates exceeded the detection limit in three of these areas. The quarterly average S^{35} emission rates from 105-C, 105-DR, and 105-F were 5.9×10^{-4}, 1.5×10^{-3}, and 1.8×10^{-3} curie per day, respectively. General decreases in the activity density of alpha and beta particle emitters and in the concentration of radioactive particles were noted at nearly all reactor area stacks this quarter. One unusually high emission of beta particle emitters occurred at 105-H during rupture of a slug. On November 1, 1955, about 0.7 curie was emitted from this stack during a relatively short period of time. The majority of this activity was Np^{239} with a 2.3 day half-life.

Quarterly average and maximum beta particle emitter emission rates from the 327 Building stack in 300 Area were 2.2×10^{-4} and 9.2×10^{-4} curie per day as measured by filter and scrubber samples.

SECTION II: RADIOACTIVE CONTAMINATION ON VEGETATION

The activity density of I^{131} on vegetation remained at the same low level as the average measurements for last quarter. No deposition of I^{131} above the Hanford tolerance level was measured outside of the project and only minor amounts of deposition occurred in and around the separations areas. The concentrations of non-volatile beta particle emitters remained at the low values reported last quarter during October and November, but extensive bomb fallout throughout the Pacific Northwest during December increased the average concentrations 2 to 3 times over October and November values.

SECTION III: RADIOACTIVE CONTAMINATION IN THE ATMOSPHERE

Dose rates measured by Victoreen Integrons remained at average values ranging from <0.1 to 6.3 mrad/day in and near the production areas. No significant changes were measured by detachable ionization chambers in the average dose rates present in all locations. The activity density and concentrations of beta particle emitters filtered from air continued at a low level during October and November, but increased significantly during December. This increase was the result of nuclear detonations. The concentration of airborne I^{131} remained normal for the quarter.

SECTION IV: RADIOACTIVE CONTAMINATION IN HANFORD WASTE

The average activity of beta particle emitters discharged to the Columbia River from reactor retention basins decreased significantly in all reactor areas, except 100-H and the new 100-K Areas. The changes, in general, were the result of fluctuating power levels and the total time of normal operations. I^{131} discharged to the river from the Animal Farm averaged 17 μc/day. Ground contamination incidents occurred in and around the B-Y Tank Farm and the 100-H Area. Particle frequency maps covering the plant and adjoining areas may be referred to in the text.

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SECTION V: RADIOACTIVE CONTAMINATION IN THE COLUMBIA RIVER AND RELATED WATERS

A decrease in the average flow rate of the Columbia River from 1.7×10^{6} gps last quarter to 5.8×10^{5} gps this quarter, resulted in general increases in the beta particle emitter activity density of river water and raw water derived from the Columbia River. Beta particle emitter activity density in the Columbia River water ranged from less than 5×10^{-8} µc/ml above the Hanford Works to 1.3×10^{-5} µc/ml at the Hanford Ferry landing. Maximum measurements obtained below McNary Dam were 3.3×10^{-7} µc/ml just below the dam and 1.5×10^{-7} µc/ml at the Washington side of the Lyle Ferry landing.

Additional increases in the measurements reported for this quarter for raw water activity density resulted from the addition of a decay correction factor to the calculation of these sample results. Most notable change in reported activity densities occurred for samples collected from the 283-E and 283-W Buildings. Quarterly average values for these two locations were 1.5×10^{-6} µc/ml, an increase by a factor of 30 over previous quarter averages.

SECTION VI: RADIOACTIVE CONTAMINATION IN RAIN

The amount of precipitation during the quarter was more than twice that recorded for the same quarter during the three previous years. The activity densities of beta particle emitters in rain were highest in the vicinity of the Redox Plant where an average concentration of 2.1×10^{-6} µc/ml included a maximum of 4.6×10^{-5} µc/ml. Concentrations at all other locations were in the range of $(<1 \text{ to } 11) \times 10^{-6}$ µc/ml.

SECTION VII: RADIOACTIVE CONTAMINATION IN DRINKING WATER AND TEST WELLS

Average concentrations of alpha particle emitters at or above the detection limit of 5×10^{-9} µc/ml were obtained from eight drinking water supplies this quarter; Larsen Farm, Benton City Store, Benton City Water Company, and Richland Wells #4, #12, #13, #14, and #15. All of these water sources were supplied from wells and the alpha activity was confirmed by uranium analyses. A maximum alpha particle emitter activity density of 1.5×10^{-8} µc/ml was measured at both the Benton City Water Company well and the Benton City Store well where natural uranium activity has consistently been found in the past.

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The addition of a decay correction factor to the calculation procedure used for samples of drinking water supplies derived from the Columbia River resulted in increases in the reported beta particle emitter activity density of factors of up to ten this quarter. The average values for activity density in all drinking water ranged from (< 0.5 to 49) x 10^{-7} μc/ml this quarter; average values for Pasco and Kennewick water supplies were 6.5 x 10^{-7} and 1.0 x 10^{-6} μc/ml, respectively. The increasing trend noted last quarter in the alpha particle emitter activity density in Well 303-8 continued into the present quarter when the average value was 1.2 x 10^{-7} μc/ml. As in the past, uranium activity was detected in the 300 Area Wells #1, #3, and #4.

INTRODUCTION

This document summarizes the results obtained from monitoring the Hanford environs for radioactive contamination during the period October, November, and December 1955. Samples were collected by Regional Monitoring forces according to procedures previously outlined in documents of this series.[1, 2] These samples were analyzed by Radio-Analysis Laboratory forces according to procedures and techniques described in a previously published laboratory manual.[3]

Counting rates obtained from these analyses were corrected for geometry, backscatter, air-window absorption, source size, self-absorption, chemical yield, and collection efficiency by Radio-Analysis Laboratory forces using factors described in previous reports.[4, 5] Additional corrections for decay were applied to those samples in which significant amounts of short half-life beta particle emitters were found. The findings obtained from analyzing the direct samples were supplemented with readings obtained from portable and fixed instrumentation.

The results obtained from the described efforts are presented in Sections I through VII. These sections discuss the amounts of active material discharged from plant facilities and their effect on the contamination of vegetation, air, soil, and water.

SECTION I

RADIOACTIVE CONTAMINATION IN EFFLUENT GASES

Radioactive contaminants in the separations and reactor area effluent gases released to the Hanford environs were sampled at the stacks and the stack breechings. Daily filter and scrubber samples from the separations areas were analyzed for I^{131} and $Ru^{103-106}$ activity density. Weekly filter, tritium oxide, and C^{14}-S^{35} samples were taken at the reactor areas and analyzed radiochemically. Summaries of the results obtained from measurements in each manufacturing facility are presented below.

SEPARATIONS AREAS

200 EAST AREA - SEMI-WORKS

Filter and scrubber samples taken from the fifty foot level of the Semi-Works stack were analyzed for total beta particle emitters. The combined results of these analyses calculated as curies per day emitted from the stack are summarized in Table I.

[redacted]

TABLE I

BETA PARTICLE EMITTERS DISCHARGED
FROM THE SEMI-WORKS STACK
OCTOBER, NOVEMBER, DECEMBER
1955

Units of Curie Per Day

Month	Maximum	Average
October	1.3×10^{-3}	4.8×10^{-4}
November	2.2×10^{-3}	$<7.0 \times 10^{-5}$
December	$<5.2 \times 10^{-5}$	$<3.7 \times 10^{-5}$
Quarter	2.2×10^{-3}	$<1.9 \times 10^{-4}$
Last Quarter	1.2×10^{-2}	$<9.0 \times 10^{-4}$

Slight, but non-significant, decreases noted last quarter in the average activity density of beta particle emitters in the Semi-Works effluent gases, continued into the present quarter. The average value this quarter is one-twentieth of that noted during the second quarter of 1955 when operations were again resumed at this facility.

200 WEST AREA - T-PLANT

A summary of the results of I^{131} measurements at the fifty foot level of the T-plant stack is presented in Table II.

TABLE II

IODINE-131 DISCHARGED FROM THE T-PLANT STACK
OCTOBER, NOVEMBER, DECEMBER
1955

Units of Curies Per Day

Month	Maximum	Average
October	1.9	0.69
November	3.8	0.48
December	0.09	0.04
Quarter	3.8	0.40
Last Quarter	8.2	0.83

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The downward trend in the average daily I^{131} emission from T-Plant stack noted the previous two quarters was continued this quarter; the average I^{131} emission was 0.40 curie per day during the present quarter, compared to 0.83 curie per day during the previous quarter and 1.3 curies per day during the second quarter of 1955.

200 WEST AREA - S-PLANT

Table III presents a summary of the results of I^{131} monitoring at the twenty foot level of the S-Plant stack.

TABLE III

IODINE-131 DISCHARGED FROM THE S-PLANT STACK
OCTOBER, NOVEMBER, DECEMBER
1955
Units of Curies Per Day

Month	Maximum	Average
October	2.5	1.3
November	1.6	0.27
December	1.6	0.25
Quarter	2.5	0.62
Last Quarter	6.8	0.87

Decreases similar to those at T-Plant were noted this quarter in the average and maximum daily I^{131} emission from the S-Plant stack. The efforts, being extended by the Manufacturing Department at T and S-Plants, toward reducing the I^{131} emission from these facilities are the main reason for these decreasing trends.

The results obtained from ruthenium monitoring at the S-Plant stack are summarized in Table IV.

[redacted]

TABLE IV

RADIOACTIVE RUTHENIUM DISCHARGED FROM
THE S-PLANT STACK
OCTOBER, NOVEMBER, DECEMBER
1955
Units of Curie Per Day

Month	Maximum	Average
October	<0.04	<0.01
November	<0.03	<0.02
December	0.12	<0.02
Quarter	0.12	<0.01
Last Quarter	<0.02	<0.01

One positive ruthenium measurement was obtained this quarter; 0.12 curie per day was emitted during the period from December 21 to December 22. This value represents the first positive ruthenium measurement obtained at this facility since the fourth quarter of 1954, when the quarterly maximum value was 0.4 curie per day.

200 WEST AREA - U-PLANT

Table V presents a summary of the results from filter monitoring at the ten foot level of the U-Plant stack.

[redacted]

TABLE V

RADIOACTIVE PARTICULATE MATERIALS DISCHARGED FROM THE U-PLANT STACK OCTOBER, NOVEMBER, DECEMBER 1955

	Alpha Particle Emitters Units of 10^{-8} curie/day		Beta Particle Emitters Units of 10^{-5} curie/day		Radioactive Particle Concentrations Units of 10^{5} Particles/day	
Month	Max.	Avg.	Max.	Avg.	Max.	Avg.
October	4.5	1.1	51	3.0	0.7	0.4
November	2.7	1.1	31	7.3	39	7.4
December	0.63	0.24	31	7.2	3.2	6.8
Quarter	4.5	0.81	51	5.9	39	5.1
Last Quarter	1.3	0.37	1.6	0.26	38	1.5

Increases noted in the activity density of alpha and beta particle emitters and concentrations of radioactive particles in the U-Plant stack effluent this quarter are of doubtful significance when compared with fluctuations in similar values noted in the past several quarters. For example, the quarterly average activity density of beta particle emitters in these effluents for the second, third, and fourth quarters of 1955 were 2.7×10^{-5}, 0.26×10^{-5}, and 5.9×10^{-5} curie per day, respectively.

REACTOR AREAS

Measurements of tritium oxide, C^{14}, and S^{35} concentrations in the 105-KW and 105-KE reactor stacks were initiated during October 1955. Sampling of the 105-KW reactor stack effluents for particulate materials was started in July 1955; measurements of concentrations of radioactive particulate materials were initiated at 105-KE during October.

Other changes initiated this quarter were the installation of rotameters in each reactor area stack sampling system for more accurate measurement of sample flow rates and improvements in the C^{14}-S^{35} scrubber samplers to give higher collection efficiencies. Results of measurements at the reactor area stacks for tritium oxide, C^{14}, S^{35}, and particulate materials are summarized in Tables VI through XI.

TABLE VI

TRITIUM OXIDE DISCHARGED FROM REACTOR STACKS
OCTOBER, NOVEMBER, DECEMBER
1955
Units of Curie Per Day

Stack	October Max.	October Avg.	November Max.	November Avg.	December Max.	December Avg.	Quarterly Max.	Quarterly Avg.
100-B	0.05	0.03	0.05	0.02	0.08	0.05	0.08	0.03
100-C	0.16	0.07	0.60	0.14	0.62	0.23	0.62	0.15
100-KW	0.38	0.38	0.08	0.06	3.0	0.69	3.0	0.55
100-KE	--	--	0.03	0.03	1.5	0.29	1.5	0.22
100-D	0.84	0.49	3.7	0.89	0.14	0.08	3.7	0.52
100-DR	0.05	0.03	0.17	0.07	0.22	0.09	0.22	0.06
100-H	0.07	0.05	0.04	0.04	0.48	0.15	0.48	0.09
100-F	0.25	0.12	0.05	0.05	0.12	0.08	0.25	0.08

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TABLE VII

CARBON-14 DISCHARGED FROM REACTOR STACKS

OCTOBER, NOVEMBER, DECEMBER

1955

Units of 10^{-3} Curie Per Day

	October		November		December		Quarterly	
Stack	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.
100-B	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5
100-C	<4.5	<4.5	<4.5	<4.5	23	7.6	23	<4.5
100-KW	--	--	<4.5	<4.5	4.8	<4.5	4.8	<4.5
100-KE	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5
100-D	5.2	<4.5	10	<4.5	26	7.2	26	<4.5
100-DR	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5
100-H	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5
100-F	<4.5	<4.5	<4.5	<4.5	6.0	<4.5	6.0	<4.5

TABLE VIII

SULFUR-35 DISCHARGED FROM REACTOR STACKS

OCTOBER, NOVEMBER, DECEMBER

1955

Units of 10^{-4} Curie Per Day

	October		November		December		Quarterly	
Stack	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.
100-B	7.8	<4.5	<4.5	<4.5	<4.5	<4.5	7.8	<4.5
100-C	5.4	<4.5	12	<4.5	19	11	19	5.9
100-KW	--	--	25	5.7	<4.5	<4.5	25	<4.5
100-KE	<4.5	<4.5	14	4.5	7.4	<4.5	14	<4.5
100-D	11	<4.5	<4.5	<4.5	12	<4.5	12	<4.5
100-DR	11	5.4	47	25	43	14	47	15
100-H	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5
100-F	11	5.9	<4.5	<4.5	130	38	130	18

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TABLE IX

ALPHA PARTICLE EMITTERS DISCHARGED AS PARTICULATES FROM REACTOR STACKS OCTOBER, NOVEMBER, DECEMBER 1955

Units of 10^{-7} Curie Per Day

Stack	October Max.	October Avg.	November Max.	November Avg.	December Max.	December Avg.	Quarterly Max.	Quarterly Avg.
100-B	0.90	0.32	1.9	0.70	1.2	0.26	1.9	0.43
100-C	0.82	0.45	1.3	0.78	0.90	0.26	1.3	0.50
100-KW	0.22	0.22	2.2	0.71	2.7	0.71	2.7	0.66
100-KE	2.0	1.8	2.5	1.4	0.53	0.23	2.5	0.93
100-D	2.8	0.95	2.3	1.1	1.6	0.46	2.8	0.85
100-DR	3.1	1.1	1.6	0.81	0.91	0.44	3.1	0.79
100-H	5.2	1.3	3.7	0.79	3.4	1.0	5.2	1.0
100-F	2.2	1.1	1.9	1.1	1.3	0.59	2.2	0.88

TABLE X

BETA PARTICLE EMITTERS DISCHARGED AS PARTICULATES FROM REACTOR STACKS OCTOBER, NOVEMBER, DECEMBER 1955

Units of 10^{-5} Curie Per Day

Stack	October Max.	October Avg.	November Max.	November Avg.	December Max.	December Avg.	Quarterly Max.	Quarterly Avg.
100-B	150	47	42	18	32	13	150	26
100-C	34	7.2	47	12	70	8.5	70	9.3
100-KW	0.62	0.62	4.8	1.3	4.5	1.8	4.8	1.4
100-KE	1.4	1.0	1.4	0.96	4.8	2.0	4.8	1.4
100-D	340	230	520	130	582	156	582	171
100-DR	1.6	0.77	2.2	0.41	1.1	0.40	2.2	0.53
100-H	6.8	4.0	70000*	35	7.2	0.49	70000*	14
100-F	360	280	240	88	375	152	375	167

* This maximum occurred during rupture at 100-H and is not included in the average for the month.

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TABLE XI

RADIOACTIVE PARTICLES DISCHARGED
FROM REACTOR STACKS
OCTOBER, NOVEMBER, DECEMBER
1955

Units of 10^5 Particles Per Day

	October		November		December		Quarterly	
Stack	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.
100-B	22	4.7	2.2	0.7	2.7	0.1	22	2.0
100-C	36	19	76	30	320	47	320	34
100-KW	<1.0	<0.1	<1.1	<0.2	3.2	1.1	3.2	0.3
100-KE	--	--	<1.1	<0.1	3.9	1.6	3.9	1.0
100-D	--	--	11	2.7	2.3	0.7	11	1.5
100-DR	33	18	<1.0	<0.2	12	2.7	33	7.2
100-H	44	11	5.5	3.6	32	12	32	16
100-F	78	25	35	16	63	16	78	16

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The total average tritium oxide emission from all reactor stacks was 1.7 curies per day. The total this quarter, for the six reactor stacks that were also sampled during previous periods, was 0.93 curie per day compared to similar values of 1.1 and 0.62 curies per day for the second and third quarters of 1955, respectively.

Occasional positive C^{14} measurements were noted again this quarter at 105-C, 105-D, and 105-F reactor area stacks.

The December monthly averages at 105-C and 105-D stacks were 7.6×10^{-3} and 7.2×10^{-3} curie of C^{14} per day, respectively; the quarterly average daily emission remained below the detection limit of 4.5×10^{-3} curie per day at all reactor areas.

More frequent positive measurements of S^{35} activity density were noted this quarter. The general increases in C^{14} and S^{35} activity density were attributed to higher efficiencies in the scrubber samplers used to collect these contaminants and not to any actual increase in the stack emission rates. The maximum S^{35} daily emission this quarter again occurred at 105-F where 1.3×10^{-2} curie per day was emitted during December compared to a maximum value of 6.9×10^{-3} curie per day during the previous quarter.

General decreases in the activity density of alpha and beta particle emitters were noted at all reactor area stacks except 105-H and 105-F. There was a slight increase of doubtful significance in the activity density of beta particle emitters in the stack effluents for the 105-F Area where the average and maximum this quarter were 1.7×10^{-3} and 3.8×10^{-3} curie per day, respectively. Similar values for the previous quarter were 1.4×10^{-3} and 2.5×10^{-3} curie per day, respectively.

On the morning of November 1, 1955, an unusually high emission of beta particle emitters occurred at the 105-H stack. The emission of 0.7 curie occurred over a relatively short period of unknown duration (probably less than one hour) and the results of this one high measurement

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were not included in the monthly or quarterly averages. Primary cause of the unusual emission was a ruptured slug. The majority of the activity collected on the stack effluent filter sample was Np^{239} with a 2.3 day half-life.

Concentrations of radioactive particles collected on filter samples from the reactor area stacks are summarized in Table XI. The maximum measurement reported for 100-H does not include the emission of November 1 mentioned above. Because of the unusually high amount of activity on the filter, and because isotopic analysis of this activity was desired, no autoradiograph of this filter could be obtained. A procedure for changing the filter samples twice per week instead of once per week was initiated during this quarter and excessively dark filter autoradiographs have been almost eliminated.

Decreases in the average radioactive particle concentrations in the reactor stack effluents were noted at all areas except 100-C where the quarterly average was weighted by one unusually high measurement of 3.2×10^{7} particles per day during December. These decreases are coincident with the decreases noted above in the activity density of alpha and beta particle emitters.

300 AREA

327 BUILDING

Weekly filter and scrubber samples collected from the plenum of the 327 Building stack have been analyzed for gross beta particle emitters this quarter. Monthly average results for October, November, and December were 4.0×10^{-4}, 6.7×10^{-5}, and 1.8×10^{-4} curie of beta particle emitters per day, respectively. Quarterly average and maximum values were 2.2×10^{-4} and 9.2×10^{-4} curie per day.

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SECTION II

RADIOACTIVE CONTAMINATION ON VEGETATION

Determination of the radioactive contamination of vegetation in the environs was made by the radiochemical analysis of more than 2500 vegetation samples. More than 2000 of the samples were from the immediate environs and the remainder from off-area locations in eastern and southern Washington and northern Oregon. All samples were analyzed for I^{131} and 1300 were analyzed for non-volatile beta particle emitters. Fifty samples from selected locations were analyzed for alpha particle emitters.

Averages for the present and previous quarter are compared in Table I. Tables II and III show by months the average I^{131} and non-volatile beta particle contamination measured at each general location. The concentrations of alpha particle emitters on vegetation are summarized in Table IV.

The activity density of I^{131} on vegetation remained at the same low level as the average measurements from last quarter. No deposition of I^{131} above the Hanford tolerance level was measured outside of the project and only minor amounts of deposition occurred in and around the separations areas. The deposition patterns are illustrated by months in Figures 1, 2, and 3.

The concentrations of non-volatile beta particle emitters remained at the low values reported last quarter during October and November, but extensive bomb fallout throughout the Pacific Northwest during December increased the average concentrations 2 to 3 times over October and November values.

The concentration of alpha particle emitters deposited on vegetation increased significantly in and around the separations areas.

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TABLE I

RADIOACTIVE CONTAMINATION ON VEGETATION

OCTOBER, NOVEMBER, DECEMBER

1955

Units of 10^{-6} μc/gm

Location	No. Samples	Iodine-131			Non-Volatile Beta Emitters		
		Max.	Avg.	Avg. Last Qtr.	Max.	Avg.	Avg. Last Qtr.
Project							
200 West Area	78	53	6	4	860	130	89
200 West - Redox	26	41	6	4	82	43	33
200 West - Gate	61	100	11	27	570	76	54
Route 3	13	15	4	<3	---	---	--
Meteorology Tower	13	8	3	<3	370	62	46
Batch Plant	13	5	<3	<3	330	66	50
200 East Area	50	4	<3	<3	480	52	44
Near the 200 Areas	303	9	<3	<3	280	43	44
North of 200 Areas	246	29	<3	<3	530	39	36
South of 200 Areas	357	9	<3	<3	290	30	36
PSN 50-51-61	39	31	4	<3	70	34	39
Goose Egg Hill	90	10	<3	<3	120	38	38
Rattlesnake Mountain	50	4	<3	<3	47	22	42
Wahluke Slope	144	3	<3	<3	160	34	39
Off Project							
Pasco to Ringold	117	<3	<3	<3	350	39	34
Richland	126	4	<3	<3	82	24	30
Richland "Y"	13	<3	<3	<3	---	---	--
Benton City-Kiona	25	<5	<3	<3	97	27	37
Kennewick Environs	178	18	<3	<3	120	27	27
Pasco Environs	139	17	<3	<3	300	32	32
Prosser to Paterson - McNary	60	3	<3	<3	150	30	26
Eastern Washington	204	<3	<3	<3	450	23	29
So. Washington and No. Oregon	198	<3	<3	<3	390	29	22

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TABLE II

RADIOACTIVE CONTAMINATION FROM IODINE-131 ON VEGETATION

OCTOBER, NOVEMBER, DECEMBER

1955

Units of 10^{-6} μc/gm

	October		November		December	
Location	Max.	Avg.	Max.	Avg.	Max.	Avg.
Project						
200 West Area	15	5	53	6	31	6
200 West - Redox	8	3	41	8	8	5
200 West - Gate	19	9	100	15	21	7
Route 3	15	6	4	<3	4	<3
Meteorology Tower	8	4	<3	<3	6	3
Batch Plant	5	<3	3	<3	4	<3
200 East Area	4	<3	<3	<3	4	<3
Near the 200 Areas	9	<3	3	<3	6	<3
North of 200 Areas	6	<3	29	<3	5	<3
South of 200 Areas	5	<3	5	<3	9	<3
PSN 50-51-61	9	4	31	6	6	<3
Goose Egg Hill	6	<3	10	<3	6	<3
Rattlesnake Mountain	4	<3	<3	<3	--	--
Wahluke Slope	<3	<3	<3	<3	3	<3
Off Project						
Pasco to Ringold	<3	<3	<3	<3	<3	<3
Richland	3	<3	<3	<3	4	<3
Richland "Y"	<3	<3	<3	<3	--	--
Benton City-Kiona	<3	<3	5	<3	3	<3
Kennewick Environs	3	<3	5	<3	18	<3
Pasco Environs	<3	<3	5	<3	17	<3
Prosser to Paterson - McNary	3	<3	<3	<3	<3	<3
Eastern Washington	<3	<3	<3	<3	<3	<3
So. Washington and No. Oregon	<3	<3	<3	<3	<3	<3

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[redacted]

TABLE III

RADIOACTIVE CONTAMINATION FROM NON-VOLATILE BETA PARTICLE EMITTERS ON VEGETATION OCTOBER, NOVEMBER, DECEMBER 1955

Units of 10^{-6} µc/gm

	October		November		December	
Location	Max.	Avg.	Max.	Avg.	Max.	Avg.
Project						
200 West Area	610	89	860	140	700	160
200 West - Redox	74	48	46	33	82	51
200 West - Gate	130	51	560	87	570	93
Meteorology Tower	54	37	33	28	370	130
Batch Plant	330	110	81	47	47	35
200 East Area	47	28	54	34	480	100
Near the 200 Areas	79	32	280	46	210	54
North of 200 Areas	49	28	42	26	530	67
South of 200 Areas	94	24	130	25	290	42
PSN 50-51-61	50	31	43	34	70	37
Goose Egg Hill	50	29	39	27	120	52
Rattlesnake Mountain	47	22	28	22	--	--
Wahluke Slope	52	28	62	30	160	43
Off Project						
Pasco to Ringold	47	22	60	28	350	72
Richland	23	14	28	18	82	40
Benton City-Kiona	26	18	36	27	97	38
Kennewick Environs	37	14	34	18	120	51
Pasco Environs	32	18	46	19	300	63
Prosser to Paterson - McNary	91	21	38	22	150	44
Eastern Washington	42	14	72	17	390	54
So. Washington and No. Oregon	60	18	51	15	450	35

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TABLE IV

RADIOACTIVE CONTAMINATION FROM ALPHA PARTICLE EMITTERS ON VEGETATION

OCTOBER, NOVEMBER, DECEMBER 1955

Units of 10^{-8} μc/gm

Location	October Average	November Average	December Average	Quarter Maximum	Quarter Average
Near 200 Areas					
200 West Gate	87	120	290	310	170
Meteorology	36	17	140	160	65
Batch Plant	32	23	50	65	35
Route 4S, Mi. 4	17	15	22	24	19
Route 4S, Mi. 6	22	<10	22	29	18
300 Area	<10	22	38	46	22
Outlying					
Richland	<10	<10	<10	<10	<10
Pasco	<10	<10	<10	<10	<10
Benton City	<10	<10	10	12	<10

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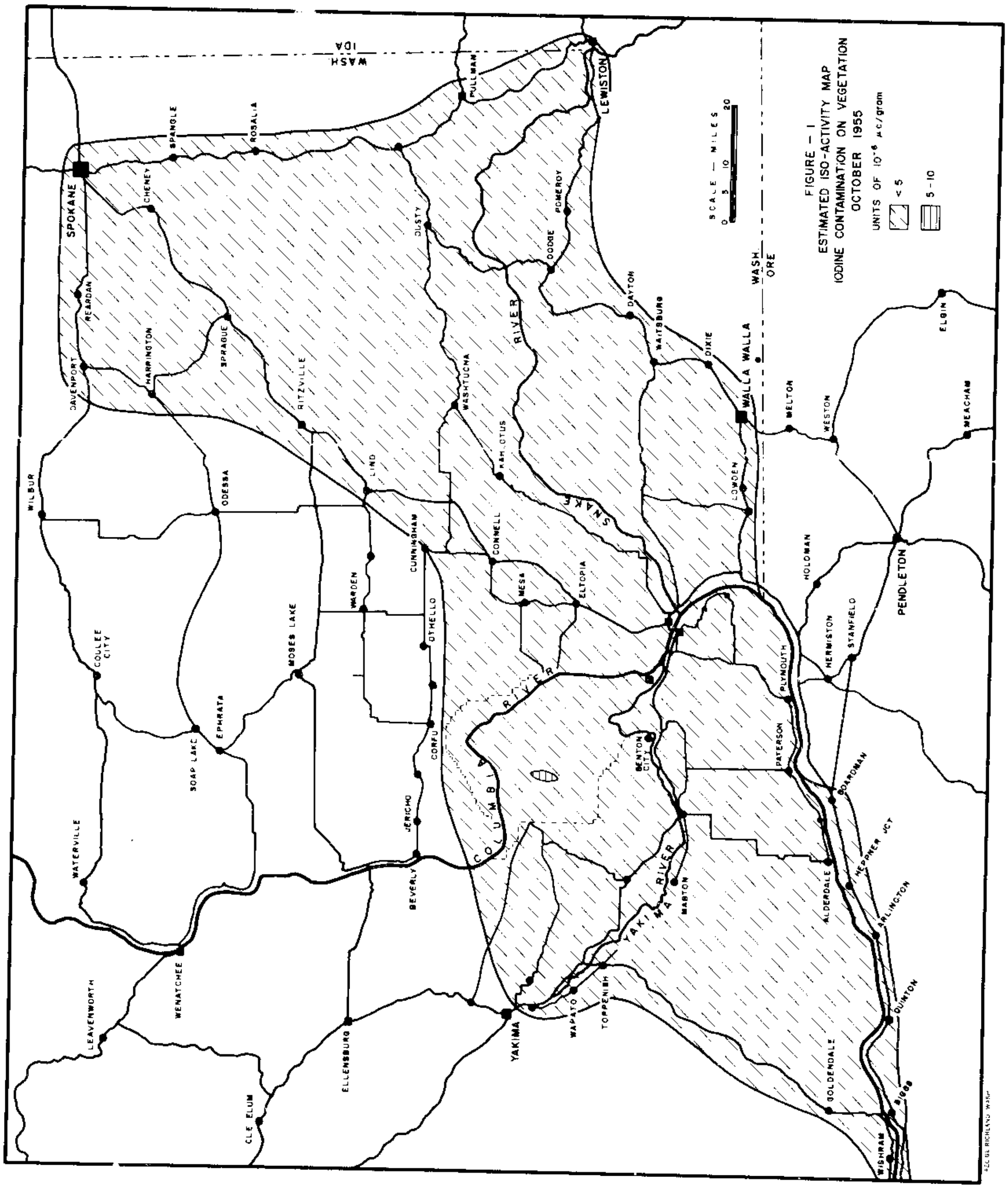

FIGURE - I
ESTIMATED ISO-ACTIVITY MAP
IODINE CONTAMINATION ON VEGETATION
OCTOBER 1955

[redacted]

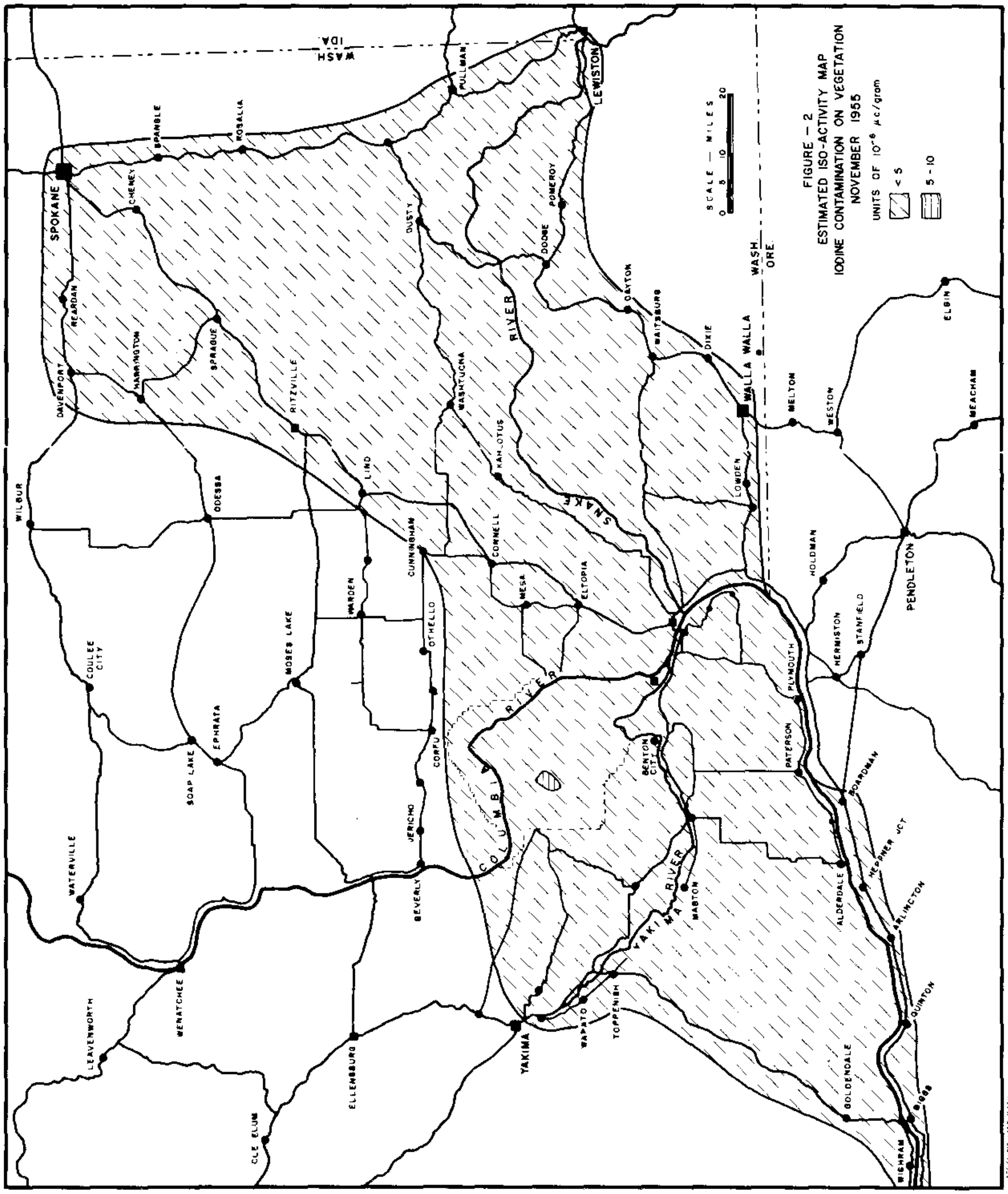

FIGURE - 2
ESTIMATED ISO-ACTIVITY MAP
IODINE CONTAMINATION ON VEGETATION
NOVEMBER 1955

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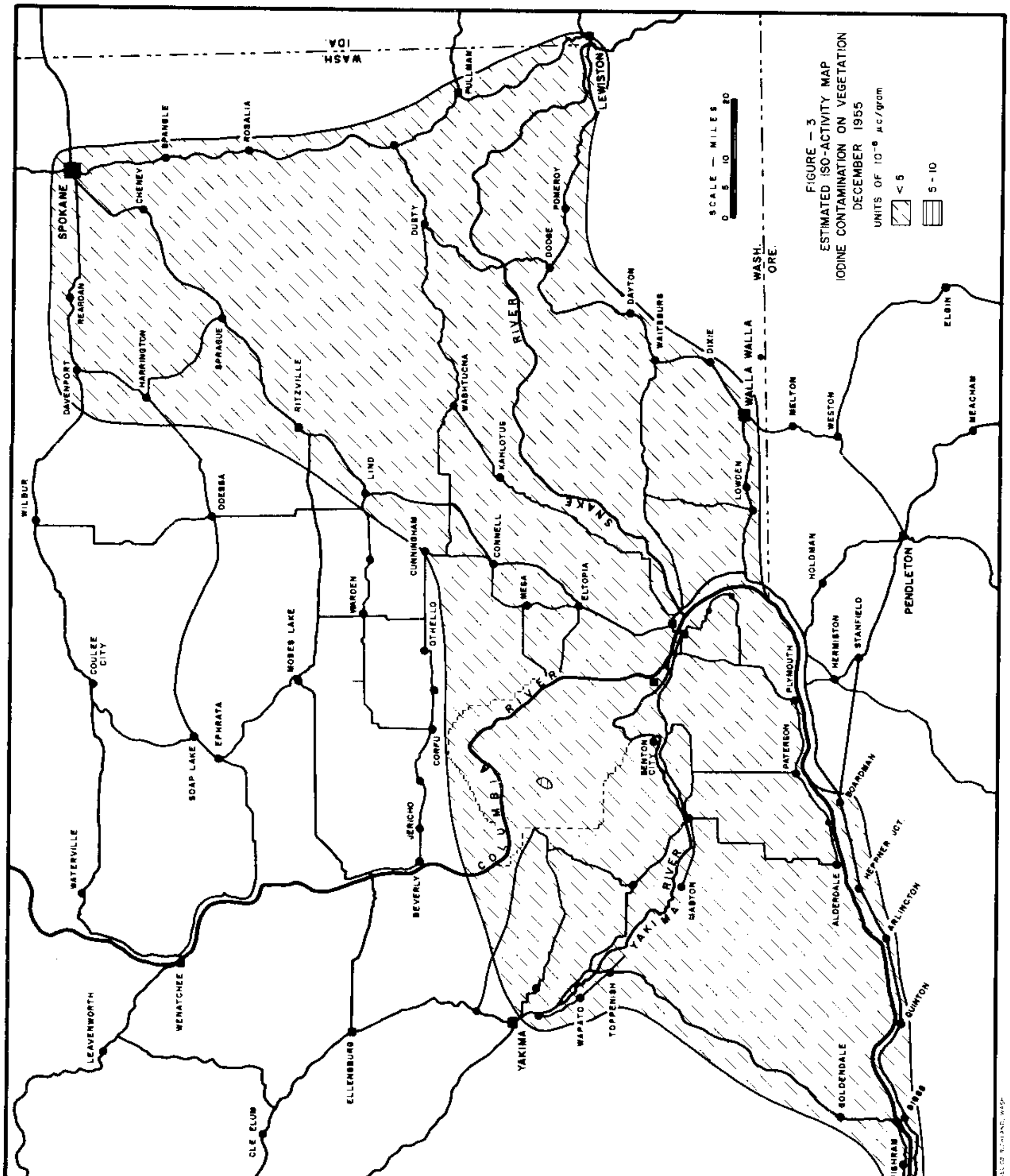

FIGURE — 3
ESTIMATED ISO-ACTIVITY MAP
IODINE CONTAMINATION ON VEGETATION
DECEMBER 1955

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SECTION III

RADIOACTIVE CONTAMINATION IN THE ATMOSPHERE

The magnitude and extent of airborne contamination in the Hanford environs were determined from analyses of filter and scrubber samples and from data recorded in the operation of Victoreen Integrons and detachable ionization chambers. The results obtained by measurements made by each of the monitoring methods during the quarter are summarized in the accompanying tables.

Victoreen Integrons were operated continuously at stations located at the perimeter of the manufacturing areas and in residential communities neighboring the plant. Accumulated dosage readings were tabulated by eight hour intervals and calculated in units of measured dosage per 24 hours. A summary of the average dosage rates for the three month period is given in Table I.

[redacted]

TABLE I

AVERAGE DOSE RATES MEASURED BY VICTOREEN INTEGRONS OCTOBER, NOVEMBER, DECEMBER 1955

Units of mrad per 24 hours

Location	No. of Units	October	November	December	Quarterly Average
Riverland	1	0.14	3.46	3.86	2.49
100-B Area	3	<0.17	< 0.19	< 0.14	< 0.17
100-K Area	3	1.57	0.93	1.79	1.43
100-D Area	3	2.31	< 0.21	< 0.13	< 0.88
100-H Area	3	0.35	0.47	0.49	0.44
White Bluffs	1	< 0.1	< 0.1	< 0.1	< 0.1
100-F Area	3	8.58	3.48	1.20	4.42
Hanford	1	1.00	0.37	0.93	0.77
200 West Area	2	6.13	9.84	2.94	6.30
Redox	1	4.46	5.31	2.29	4.02
200 East Area	3	2.79	2.30	1.12	2.07
200 East Semi-Works	1	0.92	1.09	2.87	1.63
300 Area	1	0.83	0.94	1.55	1.11
1100 Area	1	0.46	0.71	1.43	0.87
Richland	1	0.23	0.27	0.43	0.31
Kennewick	1	14.52	16.21	8.26	12.66
Pasco	1	8.78	3.21	2.01	4.67
Benton City	1	7.50	7.03	0.97	5.17

The average dosage rates remained at the same level as the values reported for the previous quarter.

The dosage rates present at stations located around the perimeter of the plant manufacturing areas were measured using detachable C-type ionization chambers. Duplicate instruments were used at each location with the minimum value of discharge included at the reported value. A summary of these dosage rate measurements is given in Table II.

TABLE II

AVERAGE DOSE RATES MEASURED WITH "C" TYPE DETACHABLE IONIZATION CHAMBERS OCTOBER, NOVEMBER, DECEMBER 1955

Units of mrad per 24 hours

Location	October	November	December	Quarterly Average
100-B Area	0.82	0.90	0.82	0.85
100-K Area	0.58	0.55	0.86	0.66
100-D Area	0.81	0.89	0.95	0.88
100-H Area	0.47	0.51	0.57	0.52
100-F Area	0.36	0.35	0.38	0.36
200 West Area	0.63	0.76	0.98	0.79
200 East Area	0.52	0.62	0.78	0.64
200 East Semi-Works	0.91	1.14	1.76	1.27

The data in Table II showed no significant change when compared with values from similar measurements made during the past year.

The dosage rates present at intermediate locations on the project and in residential areas around the plant perimeter were measured detachable M and S-type ionization chambers. Readings were obtained from these instruments at frequencies ranging from daily to weekly, and dosage rates were again reported from the chamber which showed the minimum discharge at each location. A summary of these measurements is given in Table III.

TABLE III

AVERAGE DOSE RATES MEASURED WITH "M" AND "S" TYPE DETACHABLE IONIZATION CHAMBERS OCTOBER, NOVEMBER, DECEMBER 1955

Units of mrad per 24 hours

Location	October	November	December	Quarterly Average	Group Average
100 Areas and Environs					
Route 1, Mile 8	0.67	0.66	0.74	0.69	
Route 2N, Mile 5	0.74	0.90	0.63	0.76	
Route 2N, Mile 10	0.47	0.53	0.60	0.53	
Route 11-A, Mile 1	0.90	0.82	1.59	1.10	
Intersection Rt. 1 and Rt. 4N	0.51	0.51	0.62	0.55	
White Bluffs	0.66	0.53	0.61	0.60	
Hanford 614 Building	0.50	0.36	0.29	0.38	
Military Camp, PSN 3	1.35	1.68	3.75	2.26	
Military Camp, PSN 21	1.60	0.39	3.62	1.87	0.97
200 Areas and Environs					
Route 3, Mile 1	0.65	0.63	0.79	0.69	
Route 2S, Mile 4	1.80	0.76	0.53	1.03	
Route 4S, Mile 2.5	0.81	1.20	0.88	0.96	
Route 4S, Mile 6	0.82	1.00	1.38	1.07	
Route 4S, Mile 10	0.62	0.74	1.17	0.84	
Route 10, Mile 1	1.55	2.30	3.94	2.60	
Route 10, Mile 3	0.87	1.23	0.82	0.97	
Route 11-A, Mile 6	0.30	0.37	0.43	0.37	
Batch Plant	1.66	1.06	1.02	1.25	
Redox Area	0.72	1.08	1.35	1.05	
Military Camp, PSN 42	2.44	1.10	1.01	1.52	
Military Camp, PSN 50	1.10	1.14	1.69	1.31	
Military Camp, PSN 51	1.33	2.32	1.11	1.59	
Military Camp, PSN 61	0.79	1.72	* >7.24	> 3.25	
Military Camp, PSN 70	0.64	0.88	2.51	1.34	1.32
300 Area and Environs					
Route 4S, Mile 16	0.92	0.71	1.53	1.05	
Route 4S, Mile 22	1.04	0.70	2.00	1.25	
300 Area	0.72	1.59	2.11	1.47	
1100 Area	0.74	0.45	1.57	0.92	
Military Camp, PSN 60	1.61	0.80	0.82	1.08	1.15

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TABLE III (contd.)

Units of mrad per 24 hours

Location	October	November	December	Quarterly Average	Group Average
Outlying					
Richland	0.92	0.92	0.81	0.88	
Benton City	0.47	0.45	0.72	0.55	
Kennewick	0.49	0.58	0.49	0.52	
Pasco	0.40	0.31	0.35	0.35	0.58

* All readings taken at location PSN 61 were "greater than" for the month of December 1955.

No significant differences in average dosage rates were measured at the given grouped locations compared to values found during the previous reporting period.

The activity density of beta particle emitters in the atmosphere was measured using filters through which air was passed at flow rates of 2 to 2.5 cfm for daily or weekly periods. These samples were analyzed and counted several days after their removal from the sampling location to allow for the decay of the daughter products of the natural airborne particle emitters. A summary of the results obtained from these measurements during the quarter is given in Table IV.

TABLE IV

CONCENTRATIONS OF BETA PARTICLE EMITTERS FILTERED FROM AIR

SINGLE UNIT MONITORS

OCTOBER, NOVEMBER, DECEMBER

1955

Units of 10^{-14} μc/ml

Location	October	November	December	Quarterly Average	Weekly Max.
100 Areas and Vicinity					
100-K Area No. 1	18	8	16	14	28
100-K Area No. 2	26	6	26	19	52
100-K Area No. 3	20	15	49	27	85
100-D Area	16	9	41	21	66
100-H Area	15	14	44	24	76
Hanford	<4	<4	28	11	55
White Bluffs	15	8	26	17	64
200 Areas and Vicinity					
200 East Semi-Works	15	9	21	15	31
200 West West Center	38	62	63	53	210
200 West - Redox	57	180	110	110	640
Gable Mountain	9	13	51	25	115
Military Camp, PSN 50	21	12	33	22	46
200 West East Center	42	46	81	55	160
300 Area	9	7	33	14	52
Outlying Areas					
1100 Area	11	10	37	19	75
Pasco	6	4	16	10	30
Benton City	8	10	37	17	60
Riverland	10	9	41	19	71

There was a general decrease in the concentrations of beta particle emitters filtered from air during October and November in all outlying areas with a significant increase noted at all locations in December. The general increases were the results of probable contamination from nuclear detonations.

Additional evaluations of the concentrations of beta particle emitters in the atmosphere were made by analyzing the small air filters removed from dual monitors at two locations. The results of these measurements are given in Table V.

TABLE V

CONCENTRATIONS OF BETA PARTICLE EMITTERS FILTERED FROM AIR
DUAL UNIT MONITORS
OCTOBER, NOVEMBER, DECEMBER
1955

Units of 10^{-14} μc/ml

Location	October	November	December	Quarterly Average	Weekly Max.
200-ESE No. 1	16	8	37	20	69
200-ESE No. 2	16	11	34	20	45
Richland No. 1	8	7	31	15	54
Richland No. 2	9	7	24	13	41

The quarterly averages shown in Table V reflect the same decreases during October and November and increases in December noted in the results shown in Table IV.

The number of radioactive particles in the atmosphere was determined by autoradiographing air filters through which sample air flow rates of 2.5 to 10 cfm were passed for periods ranging from daily to weekly. Monitoring stations were maintained throughout the immediate plant environs and at several remote locations in Washington, Oregon, Idaho and Montana in order to evaluate particles originating both from Hanford and from outside sources. All filters were autoradiographed for seven days using Type K X-ray film. A summary of the results of measurements near the separations areas is given in Table VI; similar results of measurements made outside the separations areas and at remote locations are given in Table VII.

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[redacted]

TABLE VI
SUMMARY OF PARTICLE CONCENTRATIONS NEAR THE SEPARATION AREAS OCTOBER, NOVEMBER, DECEMBER 1955

Units of 10^{-3} particle/meter^3

Location	October	November	December	Quarterly Average	Last Quarterly Average
200-E Vicinity					
2704 Outside	5	7	13	8	11
BY - SE	16	26	25	23	21
"B" Gate	14	4	24	14	16
2704 Inside	9	2	5	5	13
2-EWC, 614 Building	6	3	10	6	7
2701-E Inside			9	9	X
2701-E Outside			18	14	X
200-W Vicinity					
2701 Outside	34	27	60	40	77
2722	44	14	28	28	32
"T" Gate	17	1	23	13	21
222-T Outside	310	37	88	140	270
231	71	17	9	31	39
Redox	28	13	41	26	35
2701 Inside	30	31	9	23	59
272	41	55	13	26	34
2-WWC, 614 Building	6	19	16	13	14
"U" Gate	52	33	12	33	16
222-U Lab Inside	28	10	13	17	19
Meteorology Tower					
3'	4	4	2	3	6
50'	4	1	1	2	4
100'	5	2	1	2	5
150'	3	1	1	2	5
200'	6	2	2	3	8
250'	3	3	1	2	6
300'	6	3	2	3	5
350'	3	2	1	2	4
400'	4	2	2	3	5

X = No Sample.

[redacted]

TABLE VII

SUMMARY OF PARTICLE CONCENTRATIONS
OUTSIDE THE SEPARATION AREAS
OCTOBER, NOVEMBER, DECEMBER
1955
Units of 10^{-3} particle/meter^3

Location	October	November	December	Quarterly Average	Last Quarterly Average
Area Locations					
100-B Area	0.4	0.6	7	2	8
100-K No. 3	<0.4	<0.3	9	3	2
100-D Area	1	3	4	3	6
White Bluffs	2	6	6	5	7
100-F Area	2	4	6	4	11
300 Area	0.4	0.3	1	0.5	9
Off Area Locations					
Benton City, Wn.	1	<0.3	6	3	5
Pasco, Wn.	<0.4	<0.3	8	3	3
Richland, Wn.	0.4	1	12	4	6
Boise, Idaho	1	1	30	10	13
Klamath Falls, Ore.	0.4	1	24	8	6
Great Falls, Mont.	0.4	1	30	10	4
Walla Walla, Wn.	2	1	22	8	9
Meacham, Ore.	<0.4	0.3	9	3	8
Lewiston, Idaho	1	1	6	2	9
Spokane, Wn.	3	0.3	41	14	17
Kennewick, Wn.	<0.4	1	24	8	5
Yakima, Wn.	<0.3	0.3	14	4	5
Seattle, Wn.	<0.4	<0.3	19	6	1

The results listed in Tables VI and VII show normal values for October and November with a significant increase in particle deposition at all outlying locations during December. These values strongly indicate fallout from nuclear detonations and verify results from other air monitoring stations as reported in previous tables in this section and in non-volatile beta particle emitter results reported in Section II of this report.

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The activity density of I^{131} in the atmosphere was determined from the radiochemical analysis of caustic scrubber solutions through which air was passed at rates of 2 to 2.1 cfm for periods ranging from one to seven days. The results obtained from these measurements are summarized in Table VIII.

TABLE VIII

CONCENTRATIONS OF IODINE-131 DETECTED BY AIR SCRUBBERS

OCTOBER, NOVEMBER, DECEMBER

1955

Units of 10^{-12} μc/ml

Location	October	November	December	Quarterly Average	Weekly Max.
200 Areas and Vicinity					
200 East South East	<0.1	<0.1	<0.1	<0.1	<0.1
Gable Mountain	<0.1	<0.1	<0.1	<0.1	0.2
200 West East Center	<0.1	<0.1	<0.1	<0.1	0.2
200 West West Center	0.1	<0.1	<0.1	0.1	0.3
200 East Semi-Works	0.1	<0.1	<0.1	<0.1	0.1
Redox Area	0.2	<0.1	<0.1	0.1	0.5
White Bluffs	<0.1	<0.1	<0.1	<0.1	0.2
Outlying Areas					
100-K Center K-3	0.2	<0.1	<0.1	<0.1	0.3
100-H Area	<0.1	<0.1	<0.1	<0.1	0.1
300 Area	<0.1	<0.1	<0.1	<0.1	<0.1
1100 Area	<0.1	<0.1	<0.1	<0.1	0.2
Richland	<0.1	<0.1	<0.1	<0.1	0.2
Pasco	<0.1	0.1	<0.1	<0.1	0.4
Benton City	<0.1	<0.1	<0.1	<0.1	<0.1

The average activity densities of I^{131} in air compared favorably at all locations with those previously reported and indicate normal operations for the quarter. The concentrations measured in the surrounding residential areas remained generally below detection limits.

The concentration of alpha particle emitters in the atmosphere was determined by counting the same filters used for beta particle emitter

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measurements which were summarized in Tables IV and V above. A summary of the alpha measurements is given in Table IX.

TABLE IX

CONCENTRATIONS OF ALPHA PARTICLE EMITTERS FILTERED FROM AIR
OCTOBER, NOVEMBER, DECEMBER
1955

Units of 10^{-15} μc/ml

Location	No. of Samples	Weekly Maximum	Quarterly Average
200 West West Center	13	< 4	<4
200 East Semi-Works	12	< 4	<4
Gable Mountain	12	< 4	<4
Pasco	13	< 4	<4
300 Area	12	4	<4
100-D Area	13	< 4	<4
Benton City	13	< 4	<4
Hanford	12	< 4	<4
White Bluffs	10	< 4	<4
1100 Area	13	< 4	<4
200 West - Redox	13	< 4	<4
100-H Area	13	8	<4
Riverland	13	< 4	<4
Military Camp, PSN 50	11	5	<4
200 West East Center	13	4	<4
100-K No. 1	13	6	<4
100-K No. 2	13	4	<4
100-K No. 3	13	7	<4
Dual Unit Monitors			
200 East South East No. 1	13	< 4	<4
200 East South East No. 2	13	5	<4
Richland No. 1	13	< 4	<4
Richland No. 2	13	< 4	<4

The average concentrations of alpha particle emitters compared favorably with previous results and are indicative of normal operations at Hanford.

SECTION IV

RADIOACTIVE CONTAMINATION IN HANFORD WASTES

The magnitude and extent of radioactive contamination in Hanford wastes were determined from the results of over 2000 measurements. Solid and liquid samples were obtained directly from open waste areas at frequencies varying from daily to monthly; these samples were analyzed radio-chemically for the activity densities of gross alpha and beta particle emitters. Specific isotopic analyses were performed when measurements indicated unusual contamination and were carried out routinely on samples from locations which have a high probability of containing unusual quantities of certain contaminants. These measurements were supplemented with data obtained from portable instrument surveys around the perimeter of the waste storage areas and over open terrain at various locations on the plant.

The results of these measurements are summarized for each of the manufacturing areas.

100 AREA WASTE

Radioactive contamination discharged to the Columbia River from the reactor areas was determined by analyzing samples collected daily from the outlets of the coolant water retention basins. The samples were analyzed within twelve hours after collection and the measured counting rates of beta particle emitters were corrected for decay. A summary of the activity of beta particle emitters discharged to the river per unit of time is given in Table I.

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TABLE I

BETA PARTICLE EMITTERS DISCHARGED TO RIVER
IN REACTOR EFFLUENT WATER
OCTOBER, NOVEMBER, DECEMBER
1955

Units of 10^3 μc/second

Location	No. Samples	October Max.	October Avg.	November Max.	November Avg.	December Max.	December Avg.	Quarterly Max.	Quarterly Avg.
100-B	92	11	9	10	8	12	10	12	9
100-C	80	30	18	22	19	26	17	30	18
100-D	26	12	9	10	8	9	8	12	9
100-DR	94	14	10	16	10	14	10	16	10
100-H	70	8	7	15	11	19	12	19	10
100-F	64	21	16	19	14	30	16	30	15
100-KW	60	25	8	8	8	12	9	25	8
100-KE	86	8	6	9	8	13	10	13	8

A comparison of the total activity of beta particle emitters discharged to the river during this period with the results of similar measurements obtained during the previous quarter showed that significant decreases in the activity released to the river occurred at all of the older areas except 100-H which remained the same. The 100 KE and 100-KW Areas showed a significant increase as a result of rising power levels. The changes, in general, were the results of fluctuating power levels and also of the total time of normal operations.

The average activity of alpha particle emitters in reactor effluent water entering the river was less than 1×10^{-2} μc/sec at all areas. Individual samples showed trace alpha particle emitter discharge at various times during the quarter with values indicating contaminants in the range of 1×10^{-2} to 8×10^{-2} μc/sec.

[redacted]

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No positive uranium measurements were found in 168 samples analyzed specifically for uranium during the quarter.

No positive plutonium measurements were found in 33 samples analyzed specifically for plutonium during the quarter.

Significant quantities of polonium were found in samples of effluent water from 100-KW and 100-F Areas with values found of 0.005 and 0.014 μc/sec, respectively.

The activity density of I^{131} in waste discharged to the Columbia River from the Biology Farm at 100-F Area was measured by analyzing composite samples collected from the sump in the waste discharge line. An average of 17 uc/day was discharged to the river during the quarter, a value significantly lower than the discharge rates of the previous reporting periods.

200 AREA WASTES

Liquid and solid samples were collected directly from the waste sources in the separations areas and analyzed for gross alpha and beta particle emitters. A summary of the results is given in Table II.

TABLE II

RADIOACTIVE CONTAMINATION IN 200 AREA WASTE SYSTEMS
OCTOBER, NOVEMBER, DECEMBER
1955

Location	No. Samples	Alpha Particle Emitters Max.	Alpha Particle Emitters Avg.	Beta Particle Emitters Max.	Beta Particle Emitters Avg.
Liquid Samples		Units of 10^{-8} μc/ml		Units of 10^{-7} μc/ml	
T-Ditch	13	0.5	<0.5	210	50
T-Swamp	26	<0.5	<0.5	120	53
U-Swamp	23	5.2	1.3	22000	1100
Laundry Ditch	26	19	1.6	20	8.3
231 Ditch	26	1.4	<0.5	12	3.8
200-E "B" Ditch	13	21	1.7	13	4.7
200-E "B" Swamp	6	19	3.3	3.6	1.6
234-35 Ditch	12	7.1	1.1	9.4	2.6
"U" Ditch Inlet	13	1.6	<0.5	89	14
Solid Samples		Units of 10^{-6} μc/gm		Units of 10^{-5} μc/gm	
T-Ditch	12	40	7.4	64000	14000
T-Swamp	10	8	2.8	510	320
Laundry Ditch	13	320	44	59	30
200-E "B" Ditch	16	5.9	2.7	150	67
200-E "B" Swamp	8	4.6	<2	35	12
234-35 Ditch	12	4900	1100	43	6.8

The various increases and decreases noted when comparing the measurements summarized in Table II with the data collected during the preceding period were caused by the normally wide variation of concentrations in the waste systems.

The most significant changes were a decrease in beta particle emitter activity in T-ditch and swamp liquids and an increase in U-swamp and ditch liquids. The results from specific analyses of 200 Area waste for uranium are reported in Table III.

TABLE III

RADIOACTIVE CONTAMINATION IN 200 AREA WASTE SYSTEMS OCTOBER, NOVEMBER, DECEMBER 1955

Liquid Samples

Location	No. Samples	Uranium Units of $10^{-9}\mu c/ml$ Max.	Avg.
200-E "B" Ditch, 2nd U Pass	1	23	23
200-W "T" Swamp Inlet	13	28	2.8
200-W "U" Swamp Inlet	12	16	8.9
200-W "U" Swamp, West Side	11	31	11
Laundry Ditch Inlet	13	10	2.8
Laundry Ditch, 600' from Inlet	13	10	4.4
"U" Ditch Inlet	13	14	3

Solid Samples

Location	No. Samples	Units of $10^{-6}\mu c/gm$ Max.	Avg.
"B" Ditch Inlet, 200-E	10	2.6	1.1
"T" Ditch Inlet, 200-W	11	6.7	1.4
234-35 Ditch Pipe Outlet	10	350	48
Laundry Ditch Inlet	13	66	16

The values listed in Table III for uranium in liquid and solid waste appear to be normal when compared with values obtained during previous quarters.

Portable instrument surveys using GM type meters were performed at the perimeter of all open waste zones in the separations areas. Counting rates obtained over mud showed values ranging from 200 to 80,000 c/m at 200 West Area locations, while all 200 East locations showed counting rates of less than 2,000 c/m above background.

Readings obtained over the waters at the edge of the swamps and ditches ranged from 200 to 35,000 c/m at 200 West Area with background readings obtained in 200 East.

[redacted]

300 AREA WASTE

Radioactive contamination in waste in the 300 Area was measured in samples collected directly from the north pond inlet. Table IV summarizes the results obtained from the radiochemical analyses for alpha particle emitters, beta particle emitters, uranium, and plutonium.

TABLE IV

RADIOACTIVE CONTAMINATION IN 300 AREA POND INLET
OCTOBER, NOVEMBER, DECEMBER
1955

Liquid Samples	No. Samples	Activity Density Units of 10^{-8} μc/ml Max.	Avg.
Beta Particle Emitters	57	25000	520
Alpha Particle Emitters	57	43000	850
Uranium	58	33000	630
Plutonium	58	7.7	1

Individual samples from the 300 Area pond inlet varied widely in activity density as was expected in this waste stream. The values are significantly higher than those obtained for the previous quarter.

ENVIRONS - GROUND CONTAMINATION

Ground surveys were completed along the side of roads on and adjacent to the project with 2,000 square feet surveyed at one-mile intervals. The patterns of particle frequencies found during these surveys in October and November are shown in Figures 4 and 5. Weather conditions during December prevented completion of sufficient ground surveys to allow presentation on a map.

Some new ground contamination occurred in and around the B-Y Tank Farm during October with an average frequency of one particle per 150 square feet and a maximum dosage rate of 115 mrad. The contamination was from diversion boxes around the B-Y Tank Farm and from the B-Y Tank Farm itself.

An investigation of the penetration of particles into the soil near Redox indicated that the first four inches of soil were heavily contaminated and that a small number of particles penetrated the soil to at least six inches.

A considerable amount of new ground contamination occurred during November in and around the 100-H Area as a result of a particulate discharge of >0.7 curie of beta activity from the 105-H stack. The ground contamination extended from the Columbia River behind the 100-H Area west-north-west in a band about one and one-half miles wide to a point beyond Route 1, Mile 3. This area of about seven square miles included all locations found with a particle frequency of 1 or more particles per 400 square feet. The majority of the particles were not detectable by portable instruments in December.

Ground surveys of selected locations in the Tri-City Area showed an average frequency of particles detectable by portable instruments of one particle per 6,500 square feet.

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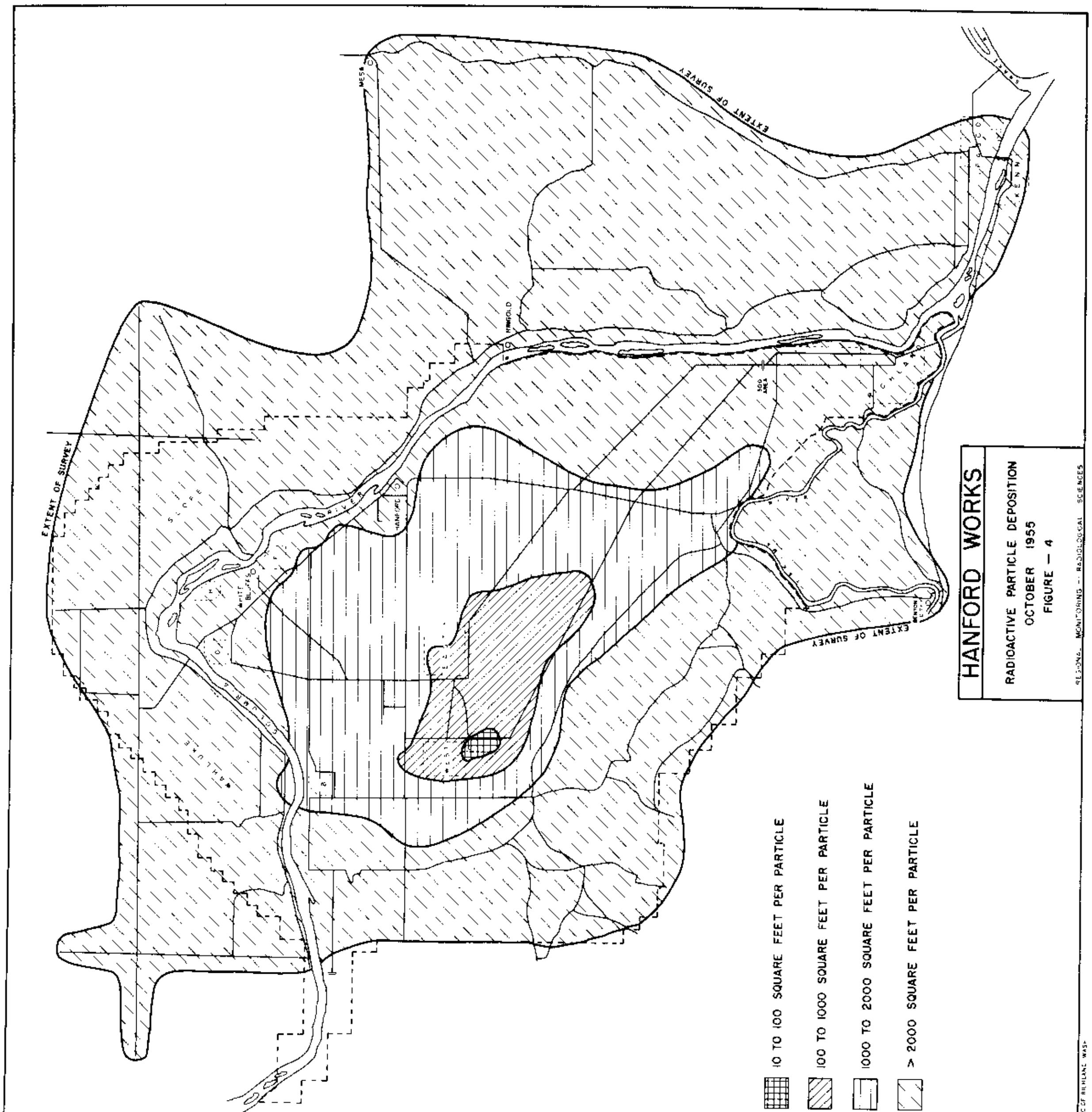

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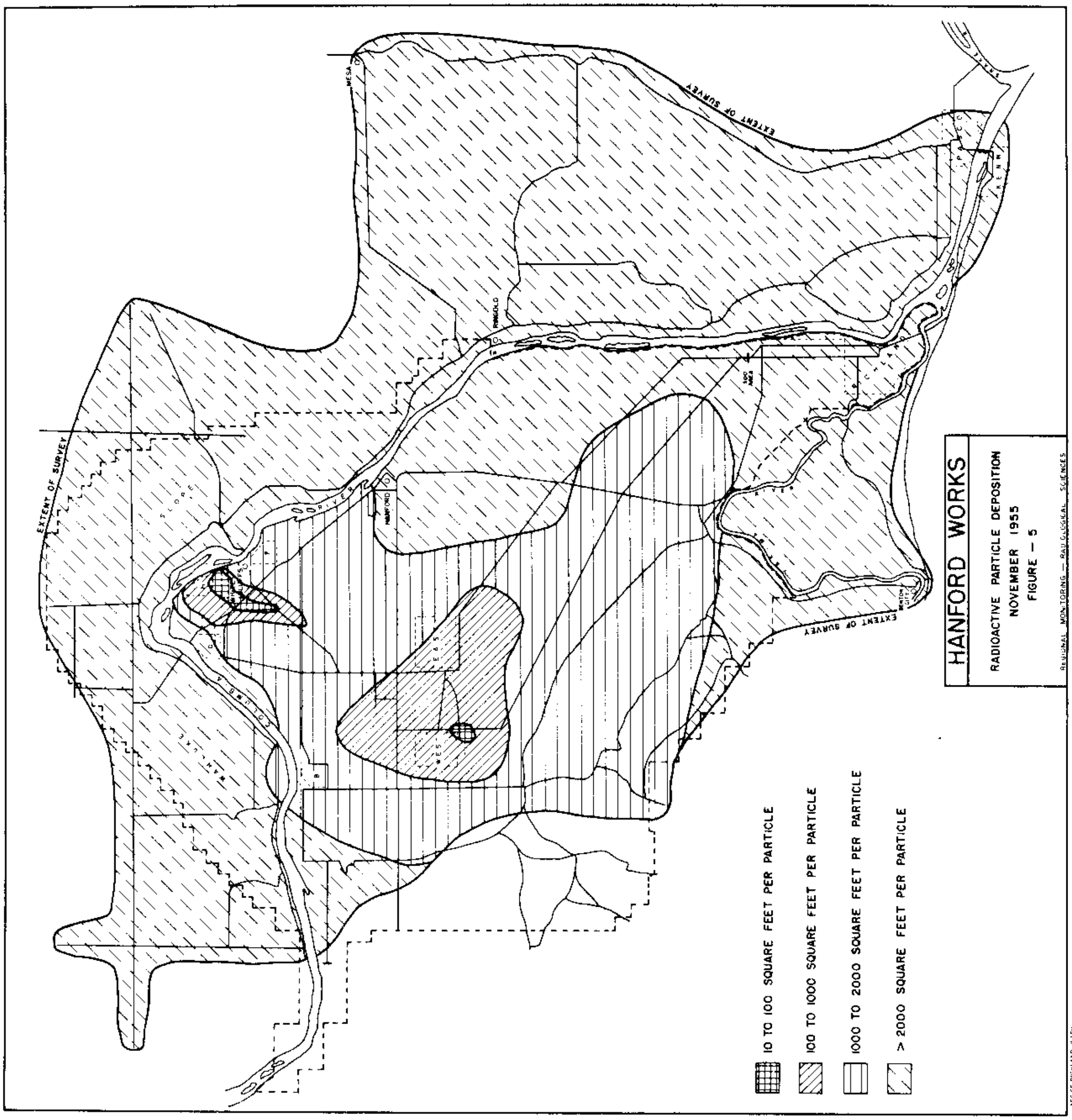
HANFORD WORKS
RADIOACTIVE PARTICLE DEPOSITION
NOVEMBER 1955
FIGURE - 5
10 TO 100 SQUARE FEET PER PARTICLE
100 TO 1000 SQUARE FEET PER PARTICLE
1000 TO 2000 SQUARE FEET PER PARTICLE
> 2000 SQUARE FEET PER PARTICLE
EXTENT OF SURVEY
EXTENT OF SURVEY
EXTENT OF SURVEY
MESA
RINGOLD
HANFORD

SECTION V

RADIOACTIVE CONTAMINATION IN THE COLUMBIA RIVER AND RELATED WATERS

Approximately 600 samples of water were collected from the Columbia, Yakima, and Snake Rivers to determine the radioactive contamination resulting from the discharge of reactor cooling water to the Columbia River. Daily and weekly 500 ml samples were collected at the Hanford Works and downstream to McNary Dam; monthly one gallon samples were collected from the Columbia River between McNary Dam and Portland. All samples were analyzed for gross beta and alpha particle emitters.

Only one river water sample revealed a positive gross alpha activity density this quarter. The sample collected from below 300 Area on December 12, 1955, contained 1.2×10^{-7} μc/ml of gross alpha emitters; further analysis of this sample revealed that all of the alpha activity was due to uranium, presumably from 300 Area wastes. The activity density of beta particle emitters in river water is summarized in Table I.

TABLE I

CONCENTRATION OF BETA PARTICLE EMITTERS IN RIVER WATER

OCTOBER, NOVEMBER, DECEMBER

1955

Units of 10^{-8} μc/ml

Location	Oct. Avg.	Nov. Avg.	Dec. Avg.	Qtr. Avg.	Last Qtr. Avg.	Max. This Qtr.
Columbia River						
Will's Ranch	< 5	< 5	< 5	< 5	< 5	< 5
181-B	< 5	< 5	< 5	< 5	< 5	< 5
181-C	< 5	< 5	< 5	< 5	< 5	< 5
Allard Station	< 5	< 5	17	7.9	7	12
181-KW	340	270	220	290	85	870
181-KE	210	380	430	300	73	680
181-D	520	680	470	560	300	1100
181-H	630	640	910	710	420	1500
Below 100-H	690	1100	980	930	1400	1400
181-F	830	1300	1400	1200	730	1900
Below 100-F	1200	790	1400	1100	620	2100
Hanford	1100	1200	1700	1300	990	4800
300 Area	310	480	510	420	380	550
Byers Landing	250	350	390	340	250	550
Richland	240	290	360	290	250	430
Kennewick Highlands Pumping Station	230	130	150	180	220	300
Pasco Bridge (Kenn. Side)	120	130	170	140	160	300
Pasco Bridge (Pasco Side)	150	190	190	180	180	260
Pasco Filter Plant Pumping Station	160	210	260	210	200	420
Sacajawea Park	170	130	110	140	120	500
McNary Dam Pool	24	33	-	28	44	42
Below McNary Dam	12	20	27	20	26	33
Paterson	14	17	22	18	25	28
Snake River						
Mouth	25	< 5	< 5	11	< 5	110
Yakima River						
Mouth	< 5	< 5	< 5	< 5	< 5	< 5
Horn	< 5	< 5	< 5	< 5	< 5	5.8
Prosser	< 5	< 5	< 5	< 5	< 5	< 5
3000 Area Pond Inlet	< 5	-	< 5	< 5	< 5	< 5

[redacted]

General increases in the beta particle emitter activity density of the Columbia River water in the vicinity of the Hanford Works this quarter were related to decreased river flow rates which resulted in lowered dilution of the reactor effluent water. At locations below Richland, the activity density sometimes decreases with decreasing river flow due to increased travel time of the river to these downstream locations. This latter effect was noted this quarter.

The October and quarterly average activity density shown in Table I for samples collected from the Snake River mouth were weighted by one unusually high measurement of 1.1×10^{-6} μc/ml. This sample, undoubtedly, represents Columbia River water which backed into the Snake River a short distance. This effect has been noted occasionally in the past and the Snake river sampling location was moved this quarter to a point 0.5 mile upstream of the mouth to eliminate the possibility of sampling Columbia River back water.

Sampling of water and mud from the McNary Pool just upstream from the dam was discontinued after November. The 30 foot boat normally used to collect these samples capsized, due to a heavy coat of ice and high winds while docked at the dam.

The average and maximum Columbia river flow rates this quarter were 5.8×10^5 and 6.8×10^5 gallons per second, respectively; similar values for the previous quarter were 1.7×10^6 and 3.3×10^6 gallons per second, respectively. River flow rates for this and the previous quarter are shown in Figure 6.

[redacted]

[redacted]

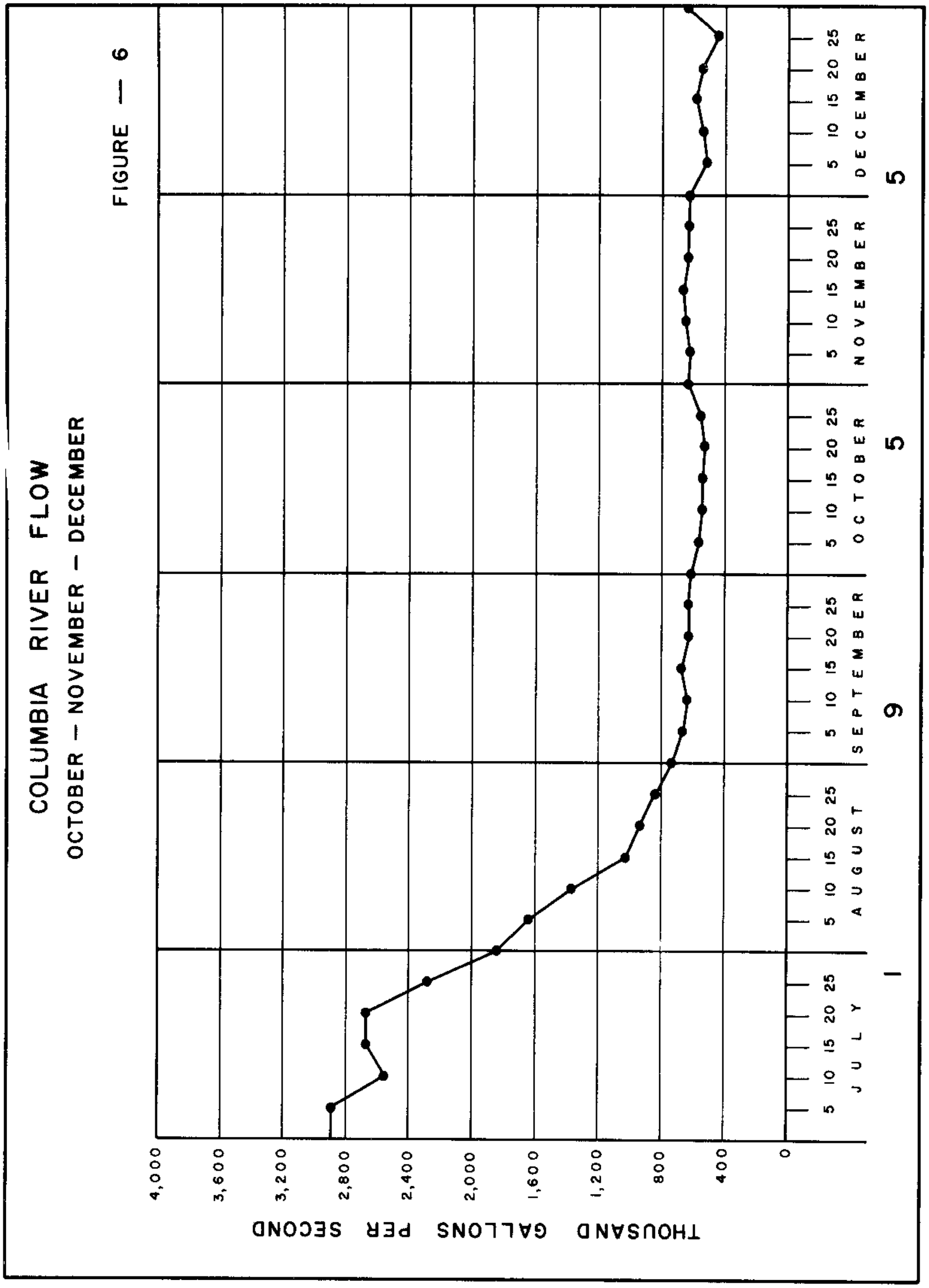

FIGURE — 6

COLUMBIA RIVER FLOW

OCTOBER – NOVEMBER – DECEMBER

[redacted]

The monthly one gallon samples collected from the Columbia River between Arlington and Portland revealed gross beta activity densities ranging from 3×10^{-8} to 1.5×10^{-7} µc/ml. This is the same range of values found during the previous two quarters. Monthly maximum measurements were as follows: 9×10^{-8} µc/ml at The Dalles in October, 6×10^{-8} µc/ml at Arlington in November, and 1.5×10^{-7} µc/ml at Lyle during December.

Twelve water samples collected from the south bank of the Columbia River at the Hanford Ferry landing were analyzed for the activity density of I^{131}. Average and maximum results for the present quarter were 5.9×10^{-8} and 1.2×10^{-7} µc/ml, respectively, compared to values of 3×10^{-8} and 1.4×10^{-7} µc/ml, respectively, obtained during the previous quarter. Slight increases resulted from decreased river flow as noted above.

Measurements of the travel time of the Columbia River from 100-B to Pasco were completed during the previous quarter and a separate report summarizing the results of these measurements will be issued in the near future.

A total of 652 river mud samples was collected from the Columbia River and nearby tributaries for measurement of gross alpha and beta particle emitters. All alpha particle emitter concentrations were below the detection limit of 3×10^{-6} µc/gm. Table II summarizes the results of the gross beta activity density measurements.

[redacted]

TABLE II

CONCENTRATION OF BETA PARTICLE EMITTERS IN RIVER MUD SAMPLES

OCTOBER, NOVEMBER, DECEMBER

1955

Units of 10^{-5} μc/gm

Location	Oct. Avg.	Nov. Avg.	Dec. Avg.	Qtr. Avg.	Last Qtr. Avg.	Max. This Qtr.
Columbia River						
Will's Ranch						
Shore	3.0	1.8	2.7	2.4	3.5	4.5
5' Out	3.6	2.0	3.0	2.8	3.0	5.3
Allard Station						
Shore	3.2	1.6	2.3	2.3	3.0	4.5
5' Out	2.7	1.7	2.3	2.2	3.0	4.2
100-H						
Shore	19	9.0	8.0	12	12	25
5' Out	15	11	8.8	12	10	27
100-F						
Shore	8.4	7.4	9.1	8.2	9.2	13
5' Out	17	6.7	11	11	9.4	22
Hanford Ferry						
South Shore	9.3	3.3	25	12	4.4	85
5' Out	15	3.5	4.4	7.3	5.5	25
300 Area						
Shore	18	6.8	2.1	9.0	5.6	43
5' Out	6.7	5.3	2.5	4.8	7.9	8.5
Byers Landing						
Shore	3.1	3.1	2.6	2.9	4.3	3.6
Richland						
Shore	5.2	4.3	2.5	3.9	3.8	8.6
5' Out	6.1	4.5	2.5	4.2	6.0	12
Kennewick Highlands Pumping Station						
Shore	3.8	3.0	2.0	2.9	2.7	4.3
5' Out	3.9	3.1	2.3	3.1	4.4	4.8
Pasco-Kenn. Bridge (Kenn. Side)						
Shore	4.4	3.1	2.5	3.2	2.9	6.0
5' Out	4.6	2.5	3.2	3.4	3.5	8.2
Sacajawea Park						
5' Out	3.5	3.2	2.0	2.9	3.0	4.8
McNary Dam Pool	5.7	4.1	-	4.9	8.3	10
Below McNary Dam						
5' Out	2.6	1.4	2.5	2.2	2.5	4.2
Paterson						
5' Out	4.0	2.3	3.4	3.2	4.0	6.1

[redacted]

[redacted]

TABLE II (contd.)

Units of 10^{-5} μc/gm

Location	Oct. Avg.	Nov. Avg.	Dec. Avg.	Qtr. Avg.	Last Qtr. Avg.	Max. This Qtr.
Snake River						
Near Mouth						
5' Out	2.7	2.5	1.8	2.4	2.8	3.8
Yakima River						
Horn						
Shore	2.4	1.8	2.3	2.2	2.3	3.8
5' Out	2.0	1.5	2.0	1.8	2.3	2.8
Prosser						
5' Out	2.9	2.0	1.9	2.3	1.9	4.3

Most of the results reported in Table II are within the range of values normally expected; only two unusually high results were obtained during the present quarter. The maximum activity density of beta particle emitters in the mud collected from the south shore of the Columbia River at the Hanford Ferry landing was 8.5×10^{-4} μc/gm this quarter, compared to a maximum of 7.9×10^{-5} μc/gm at this location during the previous quarter. The maximum measurement obtained from shore samples collected at 300 Area this quarter was 4.3×10^{-4} μc/gm, compared to a maximum of 1.3×10^{-4} μc/gm during the last quarter. Occasional high results, like these, are obtained from scattered locations within the Hanford Works and probably result from changes in the shoreline location with changes in river flow rates. At low river flows, shore mud that has been submerged during the entire annual cycle of river width changes is sampled, while during high flow rates, shore mud that is submerged only for a part of the year is taken for analysis. This makes difficult the correlation of shore and near-shore mud activity density with water activity density.

Nearly 150 samples of raw water were collected from the 183 and 283 Buildings in the reactor and separations areas for gross alpha and beta analysis. The activity density from gross alpha emitters was below the detection limit of 5×10^{-9} μc/ml in all of these samples. Table III is a

[redacted]

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summary of the results of the gross beta particle emitter analysis.

TABLE III

CONCENTRATION OF BETA PARTICLE EMITTERS IN RAW WATER

RIVER EXPORT LINE

OCTOBER, NOVEMBER, DECEMBER

1955

Units of 10^{-8} μc/ml

Location	Oct. Avg.	Nov. Avg.	Dec. Avg.	Qtr. Avg.	Last Qtr. Avg.	Max. This Qtr.
183-B	< 5	< 5	< 5	<5	< 5	< 5
183-C	< 5	< 5	< 5	<5	< 5	< 5
183-KW	240	220	280	250	21	450
183-KE	280	170	240	230	23	410
183-D	460	480	480	470	69	730
183-DR	580	650	560	600	68	1000
183-H	450	750	1000	740	110	1200
183-F	500	560	820	620	120	990
283-East	< 5	190	250	150	5.1	450
283-West	< 5	160	380	140	<5	420

The raw water samples represent water just prior to purification for drinking purposes; the activity generally follows the fluctuations in the activity density of the river water from which it is derived. The river water activity increased this quarter by factors of 2 to 4 in the vicinity of the reactor areas, while the raw water measurements reported in Table III are higher than the previous quarter's results by factors of 5 to 30. The additional increase over that expected from the increased river water activity density is due to a change in factors used to calculate the raw water activity density; a decay correction factor based on river water decay studies was added to the raw water calculations near the beginning of the present quarter. The most notable change occurred in the results reported for the 283-East and 283-West samples; water at these locations is farther (in time) from the river than any other reported in Table III. [redacted]

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SECTION VI

RADIOACTIVE CONTAMINATION IN RAIN

A total of 250 rain samples was analyzed during the quarter to determine the activity density of beta particle emitters in rain. The amount of precipitation during the quarter was more than twice that recorded for the same quarter during the three previous years. Table I summarizes the precipitation measurements made by Meteorology personnel at the Meteorology Tower near 200 West Area.

TABLE I

PRECIPITATION MEASURED AT METEOROLOGY STATION OCTOBER, NOVEMBER, DECEMBER 1955

Units - Inches

Year	October	November	December	Quarterly Total
1952	0.04	0.20	0.77	1.01
1953	0.20	0.96	0.49	1.65
1954	0.42	0.86	0.35	1.63
1955	0.40	1.54	2.03	3.97

The results obtained from radiochemical analysis of the rain and snow are given in Table II.

[redacted]

TABLE II

CONCENTRATION OF BETA PARTICLE EMITTERS IN RAIN
OCTOBER, NOVEMBER, DECEMBER
1955

Units of 10^{-6} μc/ml

Location	Number Samples	Maximum	Average
200 East Area	28	<1.0	<1.0
250' E of Stack	10	<1.0	<1.0
2000' E of Stack	8	<1.0	<1.0
3500' SE of Stack	10	<1.0	<1.0
200 West Area	41	46.0	2.1
1000' E of Stack	8	2.6	<1.0
7000' E of Stack	8	3.0	<1.0
4900' SE of Stack	8	3.2	1.3
8000' SE of Stack	8	1.3	<1.0
Redox Area	9	46.0	2.1
100 Area Environs	54	11.0	<1.0
100-B SE	10	1.2	<1.0
100-D SW	10	1.3	<1.0
100-H SE	10	11.0	<1.0
100-F SW	7	<1.0	<1.0
White Bluffs	8	2.7	<1.0
Hanford	9	<1.0	<1.0
Intermediate Locations	79	3.4	<1.0
622 Building	32	1.5	<1.0
Batch Plant	10	<1.0	<1.0
200 North	10	3.4	<1.0
Gable Mountain	8	<1.0	<1.0
Route 4S, Mile 6	9	3.4	<1.0
300	10	3.1	<1.0
Perimeter Locations	48	1.1	<1.0
1100	9	<1.0	<1.0
Riverland	10	1.1	<1.0
Richland	9	<1.0	<1.0
Benton City	8	<1.0	<1.0
Pasco	12	<1.0	<1.0

[redacted]

The average values listed in Table II show a small decrease when compared with previous results with a significant decrease noted around the 200 West Area. The absence of radioactive material from nuclear explosions in the air during any rainfall was reflected in the lower concentrations of such material in rain.

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[redacted]

SECTION VII

RADIOACTIVE CONTAMINATION IN DRINKING WATER AND TEST WELLS

Over one thousand 500 ml samples collected from drinking water supplies and test wells were analyzed this quarter to determine the radioactive contamination in these waters. A summary of the results of the analysis of 800 drinking water samples for gross alpha and beta particle emitters is presented in Table I.

 [redacted]

[redacted]

[redacted]

TABLE I

CONCENTRATIONS OF ALPHA AND BETA PARTICLE EMITTERS IN WATER SUPPLIES

OCTOBER, NOVEMBER, DECEMBER

1955

Location	No. Samples	Alpha Particle Emitters Units of 10^{-9} μc/ml Max.	Alpha Avg.	Beta Particle Emitters Units of 10^{-8} μc/ml Max.	Beta Avg.
Midway and Vicinity	35	<5	<5	5	<5
100-B (San)	13	10	<5	8	<5
100-C (San)	13	<5	<5	6	<5
100-K (San)	12	<5	<5	290	130
100-D (San)	13	<5	<5	380	170
100-DR (San)	13	<5	<5	270	160
100-H (San)	12	6	<5	260	160
100-F (San)	13	<5	<5	490	260
White Bluffs Fire Hall	13	<5	<5	360	160
Pistol Range	11	<5	<5	<5	<5
251 Building	13	<5	<5	87	26
200-East (San)	39	<5	<5	110	34
200-West (San)	51	<5	<5	410	61
300 Area Wells	13	<5	<5	6	<5
No. Richland Wells	120	6	<5	7	<5
Byers Landing	13	<5	<5	6	<5
Larson Farm	11	12	5	9	<5
Richland Wells	158	11	5	6	<5
Kennewick	37	<5	<5	100	43
Sacajawea	9	6	<5	6	<5
Pasco H and R Depot	13	<5	<5	59	38
McNary	12	<5	<5	<5	<5
Plymouth	12	<5	<5	9	<5
Paterson	12	13	7	<5	<5
Enterprise	13	<5	<5	<5	<5
Headgate	11	<5	<5	7	<5
Benton City	38	15	8	7	<5
Prosser	12	<5	<5	<5	<5

[redacted]

As in the past, positive measurements of beta particle emitter activity density were obtained from nearly all of the drinking water supplies sampled this quarter; monthly averages ranged from (<0.5 to 26) x 10^{-7} μc/ml. The range of average values noted during the previous quarter was (<0.5 to 5.3) x 10^{-7} μc/ml. The values reported for drinking water which originated from the Columbia River are significantly higher than those reported for the previous quarter because of a revision in the method of calculating these results. As in the case of raw water measurements (Section V), the measurements of drinking water which originated from the Columbia River were corrected for the radioactive decay which occurred between the time of sampling and the time of activity measurement. Increases resulting from this additional correction factor and smaller increases resulting from higher river water activity density (Section V), combined to yield average values this quarter which were higher, by factors of up to 10, than those reported last quarter.

Seven locations listed in Table I which had average values for alpha particle emitter activity density equal to or above the detection limit of 5 x 10^{-9} μc/ml were analyzed for uranium content. Table II is a summary of the results of these measurements. These locations were confined to well water supplies and the uranium activity density accounted for the majority of the alpha particle emitters present.

 [redacted]

TABLE II

CONCENTRATIONS OF ALPHA PARTICLE EMITTERS IN DRINKING WATER OCTOBER, NOVEMBER, DECEMBER 1955

Location	No. Samples	Alpha Particle Emitters Units of 10^{-9} µc/ml Max.	Alpha Particle Emitters Units of 10^{-9} µc/ml Avg.	No. Samples	Uranium Units of 10^{-9} µc/ml Max.	Uranium Units of 10^{-9} µc/ml Avg.
Richland Well #4	61	11	5	61	8	4
Richland Well #12	13	10	7	13	8	6
Richland Well #13	13	10	5	13	6	4
Richland Well #14	13	9	5	13	6	4
Richland Well #15	13	10	6	13	7	6
Benton City Store	12	15	11	13	12	9
Benton City Water Company	12	15	13	12	14	11

Supplemental samples collected from various stages in the water treatment process at the Pasco Filter Plant were analyzed for beta particle emitter activity density to determine the decontamination efficiency of this treatment process. Table III summarizes the results of these analyses.

[redacted]

TABLE III

CONCENTRATION OF BETA PARTICLE EMITTERS AT THE PASCO FILTER PLANT OCTOBER, NOVEMBER, DECEMBER 1955

Type Sample	Samples	Maximum	Average
Water Entering Plant from River	37	4.2×10^{-6} μc/ml	2.1×10^{-6} μc/ml
Sand (surface of sand filter)	5	5.4×10^{-5} μc/gm	2.5×10^{-5} μc/gm
First Backwash Material (liquid)	5	2.6×10^{-7} μc/ml	1.5×10^{-7} μc/ml
First Backwash Material (solid)	6	2.6×10^{-2} μc/gm	9.4×10^{-3} μc/gm
Coal (surface of coal filter)	11	1.3×10^{-4} μc/gm	4.0×10^{-5} μc/gm
First Backwash Material (liquid)	11	5.4×10^{-7} μc/ml	2.8×10^{-7} μc/ml
First Backwash Material (solid)	9	5.5×10^{-2} μc/gm	2.4×10^{-2} μc/gm
Water Leaving Plant	13	1.1×10^{-6} μc/ml	6.5×10^{-7} μc/ml

Comparison of values in Table III with similar values obtained last quarter, revealed that the solid materials filtered from the first backwash water from both the coal and sand filter beds increased in activity density this quarter. The average value for the solids filtered from the sand backwash water this quarter was 9.4×10^{-3} μc/gm compared to 7.4×10^{-3} μc/gm during the previous quarter. The average value for solids filtered from the coal backwash water this quarter was 2.4×10^{-2} μc/gm compared to 5.6×10^{-3} μc/gm during the previous quarter. The only other increase noted was in the average activity density of the water leaving the filter plant; the average values were 6.5×10^{-7} and 3.2×10^{-7} μc/ml for this and the past quarter, respectively. This increase was largely due to the application of the new decay correction factors, since no significant change in the average activity density of the river water entering the filter plant was noted this quarter. The ratio of the activity density of the water entering the Pasco Filter Plant to the activity density of the water leaving the plant yielded a decontamination factor of 3 this quarter. Decontamination factors of 8, 8, and 6 were obtained during the first, second, and third quarters of 1955, respectively. This factor has varied from 2 to 10 during the past two years and does not seem to depend entirely on either river water activity density or water flow rate through the plant.

Alpha particle emitters were detected in the solid material from the coal and sand filter backwash water, but not in the liquid portion nor in the water leaving the plant. Activity density of alpha emitters in these backwash solids averaged 1.0×10^{-6} and 1.4×10^{-6} μc/gm for the sand and coal backwash material, respectively. These values are not significantly different from those obtained during the previous quarter.

The results of the analysis of 280 test well samples from the Hanford Works water table for alpha and beta particle emitters are summarized in Table IV for those locations where either type of measurement yielded a positive average.

TABLE IV

CONCENTRATIONS OF ALPHA AND BETA PARTICLE EMITTERS IN TEST WELLS OCTOBER, NOVEMBER, DECEMBER 1955

Location	No. Samples	Alpha Particle Emitters Units of 10^{-9} μc/ml		Beta Particle Emitters Units of 10^{-8} μc/ml	
		Maximum	Average	Maximum	Average
107-B-1	4	<5	<5	550	220
107-B-2	4	<5	<5	490	250
108-B-1	4	<5	<5	88	59
108-B-2	4	<5	<5	120	89
107-D-1	3	<5	<5	170	73
107-F-1	4	<5	<5	370	110
107-F-3	4	<5	<5	490	200
108-F-1	4	<5	<5	100	73
108-F-2	3	<5	<5	81,000	63,000
107-H-1	4	<5	<5	82	32
361-B-1	4	10	7	<5	<5
361-B-5	4	<5	<5	8	6
361-B-7	4	<5	<5	9	6
300 Area Well #1	11	10	5	<5	<5
300 Area Well #3	12	18	11	<5	<5
300 Area Well #4	10	140	97	<5	<5
303-1	10	1000	580	<5	<5
303-2	10	900	420	<5	<5
303-3	9	540	410	<5	<5
303-4	11	310	230	5	<5
303-5	11	88	55	<5	<5
303-6	11	560	430	5	<5
303-7	2	130	75	<5	<5
303-8	2	180	120	<5	<5
303-9	2	50	44	<5	<5
303-10	2	210	200	<5	<5
303-11	2	17	13	<5	<5
303-12	2	140	140	<5	<5
3000-7	1	22	22	<5	<5
321-5	4	16	14	5	<5
321-6	4	42	31	<5	<5
321-8	4	11	8	8	<5

The list of wells with positive measurements is nearly the same as that found during the previous quarter. One addition (Well 361-B-5) and two deletions (Wells 107-H-2 and 25-80) this quarter involved wells whose quarterly average values were near the detection limit for beta particle emitter activity density. The only significant change this quarter involved Well 107-F-2, where only one measurement was obtained during the previous quarter. This one unusually high measurement of 4.3×10^{-5} μc/ml of beta particle emitters was not repeated this quarter when the average of four samples was below the detection limit.

The increasing trend noted last quarter in the average alpha particle emitter activity density in Well 303-8 continued into the present quarter. Average values for this and the previous quarter were 1.2×10^{-7} and 1.4×10^{-8} μc/ml, respectively. Samples from 300 Area Wells #1, #3, and #4 were analyzed for uranium; average values were 2.7×10^{-9}, 9.8×10^{-8}, and 8.5×10^{-8} μc/ml, respectively. The maximum measurement of 1.4×10^{-7} μc/ml was obtained at Well #3. These measurements were slightly lower than those obtained during the previous quarter when higher river levels forced the contaminated water back toward these wells.

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